

## Arenicolous Halacaridae (Acari) in Hawaiian Waters

ILSE BARTSCH<sup>1</sup>

### ABSTRACT

On beaches of the Hawaiian Islands, several marine mites were collected. Eight arenicolous species are described, viz. *Actacarus pacificus* Bartsch, *A. uniscutatus* Bartsch, *Acarochelopodia triunguis* Bartsch, n.sp., *A. biunguis* Bartsch, n.sp., *Acarochelopodia* sp., *Scaptognathus kunzi* Bartsch, n.sp., *Scaptognathides hawaiiensis* Bartsch, n.sp., and *S. ornatus* Bartsch, n.sp. The geographical distribution of these genera is outlined. On the basis of the form of leg I and the gnathosoma, hypotheses on the mode of feeding are proposed. Keys to the species of *Actacarus*, *Acarochelopodia*, *Scaptognathus* and *Scaptognathides*, known from the eastern North Pacific, are added.

All species of the genera *Actacarus*, *Acarochelopodia*, *Scaptognathus* and *Scaptognathides* are psammobionts. *Actacarus*, *Acarochelopodia*, and probably *Scaptognathides*, too, are strictly arenicolous, well adapted to inhabit the interstitium between sediment particles, whereas *Scaptognathus* live in and on the upper sediment layers.

From the northern Pacific Ocean only few records of these genera are published, e.g. *Actacarus illustrans* Newell from Alaska and Oregon (Newell 1951; Krantz 1976), *Actacarus pacificus* Bartsch and juveniles of both *Acarochelopodia* and *Scaptognathides* from the Hawaiian Archipelago (Bartsch 1979). Best studied are beaches on the Galapagos Islands which held 3 species of *Actacarus*, 2 of *Acarochelopodia*, 1 of *Scaptognathides* and 2 of *Scaptognathus* (Bartsch 1977a).

### MATERIAL AND METHODS

The mites were taken by Dr. H. Kunz and his wife during a research stay on the Hawaiian Archipelago in autumn 1979. The meiofauna had been fixed and stored in formalin. Before clearing, the mites were transferred into glycerin-acetic acid. After 4-6 weeks, the halacarids were cleared in lactic acid and mounted in glycerine jelly.

All holotypes are deposited in the Bernice P. Bishop Museum, Honolulu, Hawaii (BPBM), paratypes in Zoologisches Institut und Museum, Hamburg, FRG (ZIMH).

Abbreviations used in descriptions: AD — anterodorsal plate; AE — anterior epimeral plate; ds — dorsal setae, ds-1 — 1st pair of dorsal setae; GA — genitoanal plate; GO — genital opening; OC — ocular plate(s); P — palp, P-1 — 1st palpal segment; pas — parambulacral setae; PD — post-

<sup>1</sup>Biologische Anstalt Helgoland, Notkestr. 31, 2000 Hamburg 52, Federal Republic of Germany

erodorsal plate; PE — posterior epimeral plate(s); pgs — perigenital setae; sgs — subgenital setae; vs — ventral setae.

Leg segments: I-1 — trochanter of leg I; II-2 — basifemur of leg II; III-3 — telofemur of leg III; IV-4 — genu of leg IV; I-5 — tibia of leg I; I-6 — tarsus of leg I.

## SPECIES DESCRIPTIONS

### *Actacarus pacificus* Bartsch, 1979

Bartsch 1979: 231-234, Fig. 1-14

*Material examined.* 90 females, 11 males, 9 deutonymphs, 1 protonymph.

*Collecting data.* OAHU: Kuliouou Beach, sheltered area, coarse sediment with clay, 22 X 1979. KAUAI: Anini Beach, sheltered area, coastal subsoil water, 30 cm sediment depth, coarse sand, 01 XI 1979; Kekaha, exposed beach, medium coarse sediment, 01 XI 1979; same beach, very coarse sediment, low water edge, 01 XI 1979; same beach, close to a rivulet, 01 XI 1979 (4 ♀♀, 1 ♂ in BPBM); Anini Community, Beach Park, coarse sediment, 40-50 cm below water level (5 ♀♀ in BPBM). MAUI: Honokowai, coarse sand, 40 cm below low water level, 06 XI 1979. HAWAII: Anaeho'omalua Bay, below low water level, 14 XI 1979; Kawaihae Bay, Spencer Beach, exposed area, high water edge, 15 XI 1979. Kawaihae Bay, Harbour, coarse sediment, 15 XI 1979. City of Refuge, south of Kailua, coarse sediment, low water edge, 16 XI 1979. Kawaihae, Mauna Kea Beach, fine sand below surf zone, 18 XI 1979. MOLOKAI: Kaunakakai, coarse sand, 17 XI 1979. Mapulehu, coarse sand, 17 XI 1979.

*Diagnosis.* Length of female idiosoma 194-240  $\mu\text{m}$ , of male idiosoma 223-236  $\mu\text{m}$ . AD and PD truncate posteriorly and anteriorly, respectively. OC present. Setae ds-2 inserted at margin of AD; ds-5 at level of insertion of leg IV. AE long, with 4 pairs of setae. PE with 1 dorsal and 2 ventral setae. Ovipositor long. Rostrum long, reaching to end of P-2. Tectum truncate. Legs slender.

*Distribution.* Hitherto, *Actacarus pacificus* is known only from the Hawaiian Archipelago. Within the area studied, *A. pacificus* is most abundant.

### *Actacarus uniscutatus* Bartsch, 1977

Bartsch 1977a: 25-27, Fig. 98-106

*Material examined.* 20 females, 3 deutonymphs, 1 protonymph.

*Collecting data.* OAHU: Pupukea Beach, slope, coarse sand with clay, 0-10 cm sediment depth, 26 X 1979. MAUI: Honokowai, coastal subsoil water, 40 cm sediment depth, coarse sand, 06 XI 1979. HAWAII: Kawaihae Bay, Spencer Beach, coastal subsoil water, 15 cm sediment depth, upper slope, 15 XI 1979. Kawaihae, Harbour, coarse sand, 15 XI 1979. City of Refuge, south of Kailua, coarse sediment, low water edge, 16 XI 1979 (3 ♀♀ in BPBM).

**Diagnosis.** Length of female idiosoma 202-253  $\mu\text{m}$ . Males not seen. AD and PD forming a dorsal shield. OC present. Setae ds-2 at margin of dorsal shield, ds-5 just anterior to level of insertion of leg IV. Two pairs of gland pores posterior to ds-5. PE with 1 dorsal and 2 ventral setae. A pair of setae inserted within striated integument between AE and GA. Ovipositor long. Rostrum rather long, reaching to end of P-2. Tectum truncate. Legs slender.

**Distribution.** *Actacarus uniscutatus* previously was recorded from the Galapagos Islands (Bartsch 1977a).

### ***Acarochelopodia triunguis* Bartsch, n.sp.**

Fig. 1-9

**Material examined.** Four females, 1 holotype female in BPBM, 1 paratype female in ZIMH, 2 females in author's collection.

**Collecting data.** OAHU: Pupukea Beach, coastal subsoil water, 30 cm sediment depth, coarse sand, 26 X 1979.

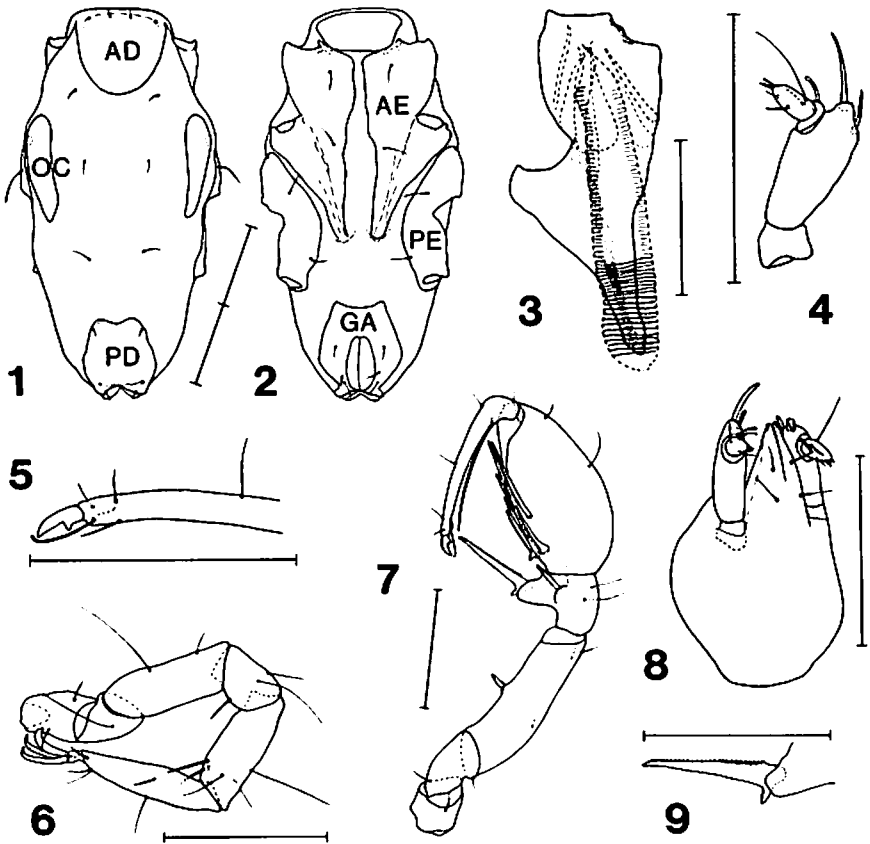
**Diagnosis.** Idiosoma length 218-230  $\mu\text{m}$ . Setae ds-1 almost at anterior margin of AD. AE prolonged posteriorly. Three claws on posterior tarsi. Tibia I with 4 ventrolateral and 2 ventromedial spines. Telofemur I slender. Tarsus I with 3 dorsal setae, the distal one inserted close to tip of tarsus.

**Description.** Female: Length of idiosoma 218-230  $\mu\text{m}$ , holotype 230  $\mu\text{m}$ . Dorsal and ventral plates delicate, finely punctate. AD almost truncate anteriorly; with 1 pair of gland pores. OC long; corneae lacking. Anterior margin of PD slightly excavated, often with pair of circular markings from muscle insertion; posteriorly, 1 pair of gland pores present. Dorsal setae minute. First pair of setae inserted close to anterior margin of AD, at level of gland pores; ds-2, ds-3 and ds-4 on minute sclerites within finely striated integument, ds-5 on PD, ds-6 close to base of anal sclerites (Fig. 1).

Anterior epimeral plate divided, each plate with 2 setae. AE prolonged posteriorly, with long apodemal sclerites for striated muscle bundles for operating leg I (Fig. 2, 3). PE with 2 ventral and 1 dorsal setae, and marginal gland pore. GA slightly concave anteriorly. GO longer than half GA. Three slender pgs on both sides of GO. Subgenital setae lacking, only minute spurs from ovipositor showing through genital sclerites.

Gnathosoma with globular base and conical rostrum (Fig. 8). Rostrum with 2 pairs of maxillary setae. Tip of rostrum slightly prolonged, snout-like, with 2 pairs of spur-like setae at tip. P-2 with 2 stout, pectinate dorsal bristles, distal one conspicuously strong. P-2 partly overlapping small P-3 and P-4. P-3 with 1 blunt-ending spine, P-4 with 3 basal setae, and at tip, 1 minute seta and 2 spurs (Fig. 4).

Leg I larger than posterior legs; with very strong bipectinate spines. Telofemur slender; with 1 ventral spine small and conical, and 3 slender dorsal setae (Fig. 7). Very large lateral spine on I-4 (Fig. 9), arising on a projecting cone; ventromedial spine shorter. Tibia I stout, with 4 ventrolateral and 2 ventromedial bipectinate spines. Tarsus I very slender,



Figures 1-9 *Acarochelepodia triunguis* Bartsch, n.sp., ♀ 1, idiosoma, dorsal; 2, idiosoma, ventral; 3, right PE, ventral (within broken lines, striated muscle bundles; dotted area, apodemes); 4, palp, lateral; 5, tip of tarsus I, medial; 6, leg III, lateral; 7, leg I, ventromedial; 8, gnathosoma, ventral; 9, ventrolateral spine on genu I. (each scale division = 50  $\mu$ m. AD anterodorsal plate; AE anterior epimeral plate; GA genitoanal plate; OC ocular plate; PD posterodorsal plate; PE posterior epimeral plate)

with 1 long ventral bristle; none of the 3 dorsal setae inserted paired. Tip of tarsus I with 1 ventral seta, 1 of the 3 dorsal setae, 1 long flagelliform seta, 1 dorsolateral seta (solenidion?) and 1 lateral seta (Fig. 5). Tibiae II, III and IV all with 1 pair of delicately pectinate bristles. Ventral bristle on genua II, III and IV, too, delicately pectinate. Tarsus II with 3 dorsal setae, 1 delicate ventromedial seta, and single eupathidia on both sides of ambulacrum. Tarsus III with 4 dorsal setae (Fig. 6), 1 seta-like pas in medial position and 1 shorter, bristle-like pas in lateral position. Tarsus IV with 3 dorsal setae, and bristle-like pas on both sides of ambulacrum. Formula for leg chaetotaxy I - IV (arabic numerals = setae; roman numerals = spines): trochanter 1-1-2-1; basifemur 2-2-1-1; telofemur 3+I-3-2-2; genu 3+II-?-3-3; tibia 3+VI-5-5-5. Tarsus I with 1 small

median claw; tarsi II to IV all with 3 claws, almost equal in length, but, median claw stout, whereas lateral claws slender.

Male: Not seen.

*Remarks.* *Acarochelopodia triunguis* is closely related to *A. cuneifera* Bartsch. It is distinguished from the latter by the longer AE, the position of ds-1 and the anteriorly slightly concave PD and GA.

***Acarochelopodia biunguis* Bartsch, n.sp.**

Fig. 10-16

*Material examined.* Two females; 1 holotype female in BPBM, 1 paratype female in ZIMH.

*Collecting data.* HAWAII: Kawaihae Bay, Spencer Beach, coastal subsoil water, 15 cm sediment depth, 15 XI 1979.

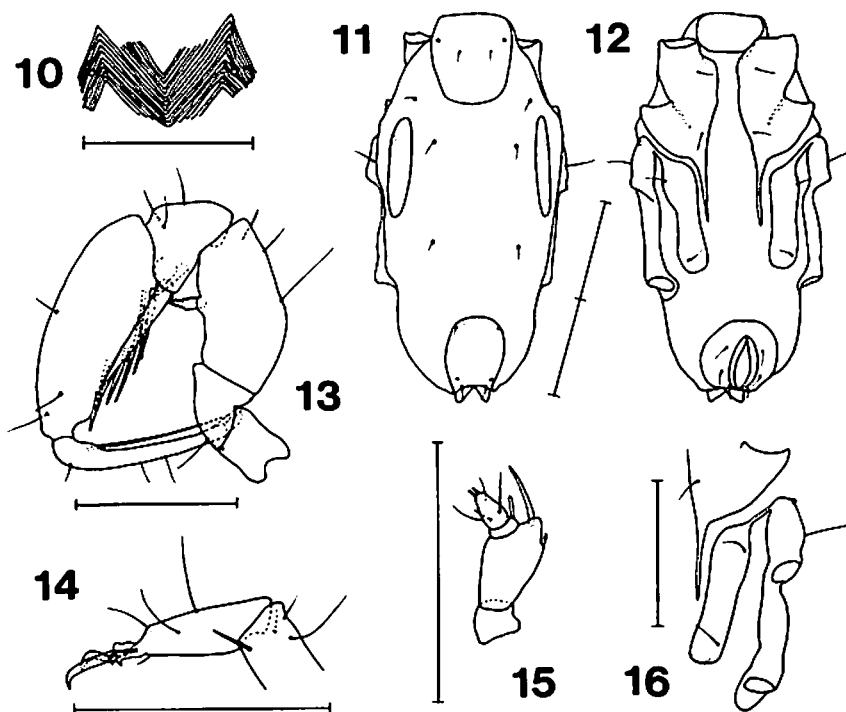
*Diagnosis.* Idiosoma length 179-194  $\mu\text{m}$ . AD and PD subquadrangular, each with 1 pair of gland pores. AE with very narrow posterior projection. PE incompletely divided by a longitudinal ribbon of striated integument. GA surpassing GO for less than half GO. Basal seta on P-2 small when compared with distal bristle. Tibia I with 4 ventrolateral and 2 ventromedial bipectinate spines. Pectinate spine on telofemur I conical. Tarsus I with 3 dorsal setae, the distal one inserted slightly posterior to mid-line of tarsus. Posterior tarsi with 2 slender, long claws and 1 minute median claw.

*Description.* Female: Length of idiosoma 179  $\mu\text{m}$  and 194  $\mu\text{m}$  (holotype). Dorsal plates delicate, embedded within striated integument (Fig. 10). AD subquadrangular. OC long. PD quadrangular. First pair of gland pores on AD, at level of insertion of leg I; 2nd pair of gland pores marginally, at edge of PE; 3rd pair posteriorly on PD. Dorsal setae minute; ds-1 on AD posterior to level of gland pores; ds-2, ds-3 and ds-4 on minute sclerites within striated integument; ds-5 and ds-6 at anterior and posterior margin of PD, respectively (Fig. 11).

Anterior epimeral plate divided longitudinally into right and left portion. AE prolonged posteriorly in form of very slender apodemal sclerite (Fig. 12). PE incompletely divided into marginal and ventral portion, with 1 and 2 setae, respectively; both portions connected by narrow bar (Fig. 16). GA round, GO large. Distance anterior margin of GO to that of GA less than half length of GO.

Gnathosomatic base globular. P-2 with 2 dorsal pectinate bristles, basal one small, distal one long (Fig. 15). P-3 with 1 bluntly ending bristle. P-4 basally with 3 setae, distally with 1 minute seta and 2 spurs.

Leg I larger than following legs. I-3 with 1 ventral conical spine, I-4 with 1 very stout lateral and 1 smaller medial bipectinate spine, I-5 with 6 bipectinate spines, viz. 4 spines ventrolaterally and 2 spines ventromedially. Tibia II with 1 slightly pectinate bristle in ventromedial position; III-5 and IV-5 both with 1 pair of pectinate bristles. Genua II, III and IV all with 1 ventral pectinate bristle. Tarsus I slender; with 3 dorsal setae; distal-most seta inserted slightly posterior to mid-line of tarsus (Fig. 13). Ventral bristle long. Tarsus II with 3 dorsal setae, 1 minute dorsomedial



Figures 10-16 *Acarocheilopodia biunguis* Bartsch, n.sp., ♀ 10, dorsal striated integument at level of ds-4; 11, idiosoma, dorsal; 12, idiosoma, ventral; 13, leg I, lateral; 14, tibia and tarsus II, medial; 15, palp, lateral; 16, PE and portion of AE, ventral. (each scale division = 50  $\mu$ m)

seta (solenidion?), 1 minute ventral seta and 1 pair of single pas (Fig. 14). Tarsus III with 4 dorsal setae, tarsus IV with 3 setae; on both tarsi 1 pair of single pas present. Small median claw on tarsus I with minute dent; lateral claws on I-6 lacking. All following tarsi with 2 slender and 1 minute median claw (Fig. 14).

Males: Not seen.

**Remarks.** *Acarocheilopodia biunguis* is easily distinguished from *A. triunguis* by the 2 long and the small median claw on the posterior legs, instead of 3 large claws.

*Acarocheilopodia* sp. A mentioned in Bartsch (1979) is supposed to be conspecific with *A. biunguis*.

#### *Acarocheilopodia* sp.

**Material examined.** One female, in author's collection.

**Collecting data.** HAWAII: Kawaihae Bay, Spencer Beach, coastal sub-soil water, 15 cm sediment depth, 15 XI 1979.

**Description.** Female: Length of idiosoma 147  $\mu$ m. Dorsal plates delicate, covered with fine layer of striated integument. AD converging posteriorly; gland pores inconspicuous. OC oblong-triangular, with me-

dial margin straight and lateral slightly protruding. PD small, anterior margin oval. Setae ds-2, ds-3 and ds-4 inserted within striated integument. AE divided by wide area of striated integument into right and left half. AE not prolonged posteriorly. PE divided longitudinally by striated integument into marginal portion with 1 seta, and ventral portion with 2 setae. GA small. GO almost meet anterior margin of GA. Basal bristle on P-2 much smaller than distal. I-3 with bent, bluntly ending ventral spine. I-4 with 1 pair of bipectinate spines; ventrolateral spine not conspicuously strong. I-5 with 4 ventrolateral and 2 ventromedial bipectinate spines. Three dorsal setae on I-6, the 2 distal ones inserted close together at level of small ventral seta. Claw on I-6 small, slender, its median dent inconspicuous. Flagellum long, protruding beyond claw for more than length of claw. Posterior tarsi with 2 slender claws and 1 minute median one.

*Remarks.* This *Acarochelopodia* is very similar to *A. aduncispina* Bartsch, a species which lives in beaches on the Galapagos Islands (Bartsch 1977a). Both are similar in size. AD, OC, AE and PE are similar in outline. Basal seta on P-2 is smaller than distal bristle. Ventrolateral pectinate spine on I-4 not markedly stout. Claw on leg I slender, flagellum very long. Posterior legs with 2 large claws and minute median one. The most eminent distinguishing character is: tibia I in *A. aduncispina* with 5 spines, in the Hawaiian species 6 spines. Moreover, PD larger, rather truncate anteriorly in *A. aduncispina*, smaller and oval in size in the Hawaiian species.

### **Scaptognathus kunzi** Bartsch, n.sp.

Fig. 17-26

*Material examined.* One female holotype, in BPBM.

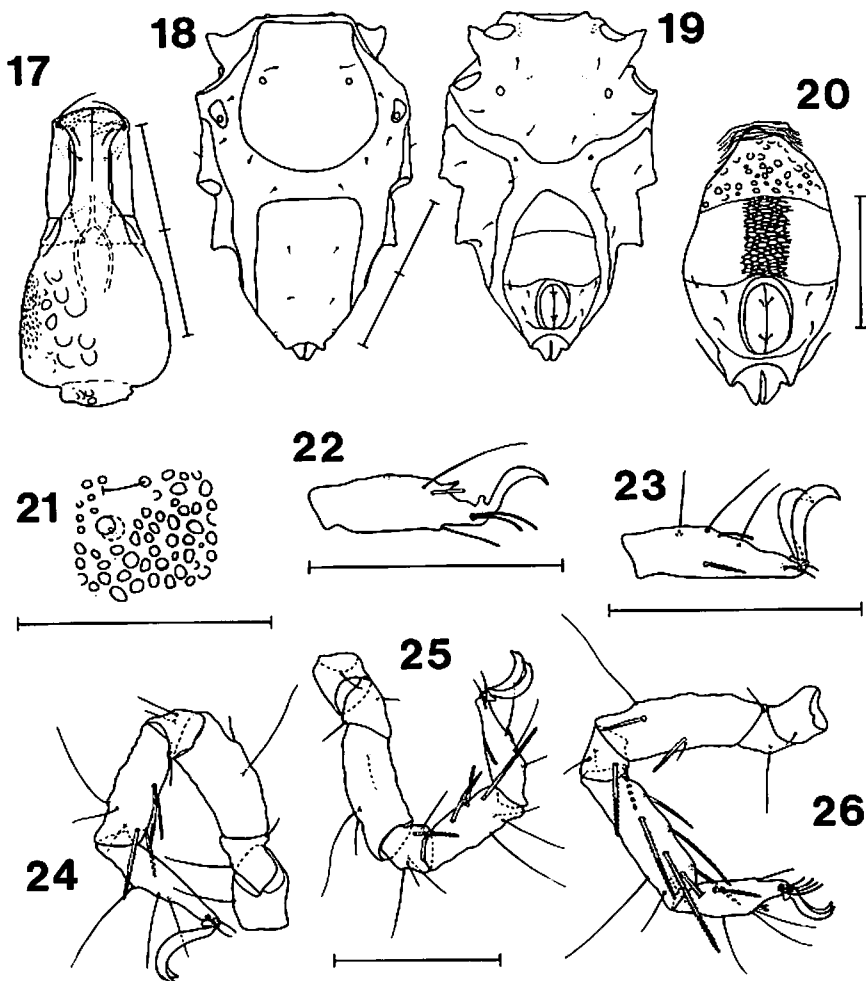
*Collecting data.* HAWAII: Kawaihae Bay, Harbour, clean, coarse sediment, 15 XI 1979.

*Diagnosis.* Idiosoma length 207  $\mu\text{m}$ , gnathosoma length 135  $\mu\text{m}$ . AD large, posteriorly rounded. PD quadrangular. GA tripartite. Number of pectinate bristles on tibiae I - IV: 6-3-4-4. Tarsi I and II both with 1 bipectinate bristle.

*Description.* Female: Length of idiosoma 207  $\mu\text{m}$ . Dorsal plates very coarsely sculptured (Fig. 21). AD large, as long as but wider than PD. OC small, slightly triangular. PD longer than wide; with truncate anterior margin. On both AD and OC 1 pair of large pores present; 3rd pair of pores in posterior end of PD (Fig. 18). First pair of dorsal setae slender, inserted just anterior to first pair of pores. Setae ds-2 to ds-5 small, arising from minute sclerites within striated integument; ds-6 and ds-7 on PD.

Ventral plates with scattered, shallow pores. Claparède organ with small pore at surface and large alveolus in deeper integumental areas. AE with 3 pairs of delicate setae (Fig. 19), PE with 1 dorsal and 3 ventral setae. GA with 3 pairs of pgs and 2 pairs of sgs. GA tripartite, anterior and posterior portion sculptured as AE, middle portion with densely packed net of small cuticular bars (Fig. 20).

Gnathosoma 135  $\mu\text{m}$  long, i.e. almost 2/3 of idiosoma length. Gnathosomatic base coarsely sculptured dorsally and marginally, weakly



Figures 17-26 *Scaptognathus kunzi* Bartsch, n.sp., ♀ 17, gnathosoma, ventral; 18, idiosoma, dorsal; 19, idiosoma, ventral; 20, genitoanal plate, ventral; 21, portion of left AD at level of gland pore and ds-1; 22, tarsus I, lateral (medial setae and claw omitted); 23, tarsus II, medial; 24, leg III, medial; 25, leg II, medial; 26, leg I, medial. (each scale division = 50  $\mu$ m)

ornamented ventrally. Rostrum slightly shorter than gnathosomatic base, spatula-shaped, widened at the tip (Fig. 17). Palps inserted dorsally, close together. No setae on P-1; P-2, P-3 and P-4 fused. Portion corresponding to P-2 with 2 setae, viz. 1 slender dorsomedial at the base and 1 dorsal slightly posterior to middle of segment. Portions corresponding to P-3 and P-4 both with 1 very stout spine.

All telofemora sculptured; lateral flank with network of cuticular bars. I-3 with 2 bipectinate bristles on medial flank, I-4 and I-5 with 1 and 3 pairs of bipectinate bristles, respectively (Fig. 26). II-4 with 1 and II-5 with



3 bipectinate bristles (Fig. 25). Tibiae III and IV both with 2 pairs of bipectinate bristles (Fig. 24). Tarsus I with 1 bipectinate bristle on medial flank, 3 dorsal setae, solenidion and famulus in dorsolateral position, 1 ventral seta (Fig. 22) and doubled eupathidia on both sides of ambulatorium. Tarsus II with 1 bipectinate bristle, 3 slender dorsal setae, 1 solenidion, and single pas laterally and medially (Fig. 23). Tarsi III and IV both with 3 dorsal setae and 1 pair of single pas. Claws on all tarsi stout, with delicate accessory process; claw comb lacking. Median claw absent.

Males: Not seen.

**Remarks.** Species of *Scaptognathus* usually have a bipartite GA, the anterior portion has densely packed cuticular bars, the posterior portion is ornamented as AE and PE. *Scaptognathus newelli* Bartsch nov. nom. (*S. punctatus* Newell, 1984, preocc.) and *S. kunzi* have tripartite GA. *S. kunzi* is easily separated from *S. newelli* by the number of bipectinate bristles: In *S. kunzi*, number of bristles on tibiae I - IV is 6-3-4-4, on tarsi 1-1-0-0, in *S. newelli*, the number on tibiae is 3-2-2-2, on tarsi 0-0-0-0.

From tropical and warm waters in the northeast Pacific Ocean *Scaptognathus pauciporus* Bartsch and *S. gibbosus* Bartsch are recorded, both are from the Galapagos Archipelago (Bartsch 1977a). None of these 2 species has a tripartite GA.

A description of *Scaptognathus punctatus* Bartsch, collected in the Mozambique Channel, was published 1981 (Bartsch). The specimens from off South America (Newell 1984) are not conspecific with *S. punctatus* Bartsch; the South American species (*S. punctatus* Newell) is named in memory of Dr. I. M. Newell (*S. newelli*).

In Bartsch (1981) a *Halacarus* was described as *Halacarus reticulatus* Bartsch. This name proved to be preoccupied — *Copidognathus reticulatus* (Trouessart, 1893). The name of the above mentioned *Halacarus* from the Mozambique Channel ought to be changed to *Halacarus dictyotus* Bartsch nov. nom.

### **Scaptognathides hawaiiensis Bartsch, n.sp.**

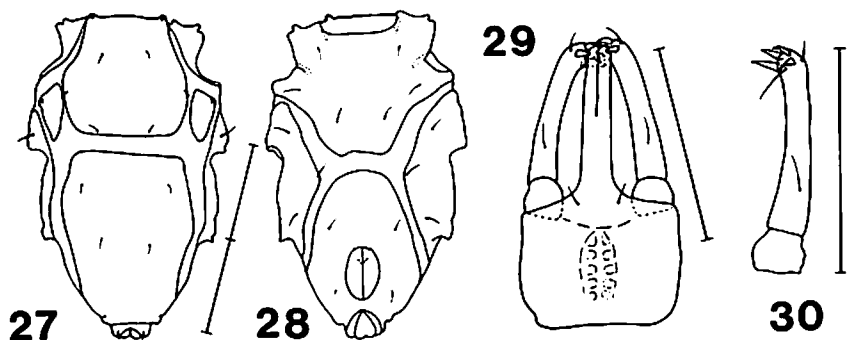
Fig. 27-30

**Material examined.** Two females, holotype in BPBM, paratype in ZIMH.

**Collecting data.** OAHU: Kaneohe Bay, Coconut Island, coastal subsoil water, 20 cm sediment depth, coral sand, 23 X 1979.

**Diagnosis.** Idiosoma length 154-164  $\mu\text{m}$ , gnathosoma length 72  $\mu\text{m}$ . Setae ds-1, ds-2 and ds-3 on AD, ds-4 on PD. No distinct gland pore in posterior corner of OC, no on PD at level of leg IV. Gnathosoma less than half the length of idiosoma. All tarsi with 3 setae.

**Description.** Female: Length of idiosoma 154  $\mu\text{m}$  (holotype) and 164  $\mu\text{m}$ . Dorsal plates covered with small, shallow pores. AD almost as wide as long; with truncate anterior and posterior margin. OC triangular. PD truncate anteriorly. First pair of gland pores at anterior margin of AD, 2nd pair in lateral corner of OC. No distinct gland pore present in posterior corner of OC. PD with gland pores only in posterior portion.



Figures 27-30 *Saptognathides hawaiiensis* Bartsch, n.sp., ♀ 27, idiosoma, dorsal; 28, idiosoma, ventral; 29, gnathosoma, ventral; 30, palp, ventral. (each scale division = 50  $\mu$ m)

Dorsal setae delicate; ds-1, ds-2 and ds-3 inserted on AD, ds-4 and ds-5 on PD, ds-6 on anal sclerites (Fig. 27).

Ventral plates delicate. AE with 3 pairs of small setae. PE with 1 dorsal and 3 ventral setae. GA with 2 pairs of pgs, genital sclerites with 1 pair of sgs (Fig. 28).

Length of gnathosoma 72  $\mu$ m. Gnathosomatic base wide, rostrum long, narrow, longer than base. First pair of maxillary setae on base of gnathosoma close to rostrum, 2nd pair in distal end of rostrum (Fig. 29). Palps 2-segmented; distal segment with 1 basal and 3 distal setae, and 4 distal spines (Fig. 30). Spines on palps slightly surpassing tip of rostrum. Chelicerae attenuate and elongate.

Leg I longer and stouter than posterior legs. Telo femur I longer and wider than all other segments. Chaetotaxy for leg I - IV: trochanter 1-1-1-1; basifemur 2-2-2-2; telofemur 4-4-2-2; genu 4-4-3-3; tibia 5-5-5-5(-6); tarsus 3-3-3-3 (pas and solenidia excluded). All tarsi with 2 claws. Claw comb on 1-6 umbrella-like. Claw comb on posterior legs delicate, with teeth fixed along ventral flank of claws.

Male: Not seen.

*Remarks.* *Saptognathides* sp. A, described in Bartsch (1979) is supposed to be the nymph of *Saptognathides hawaiiensis*.

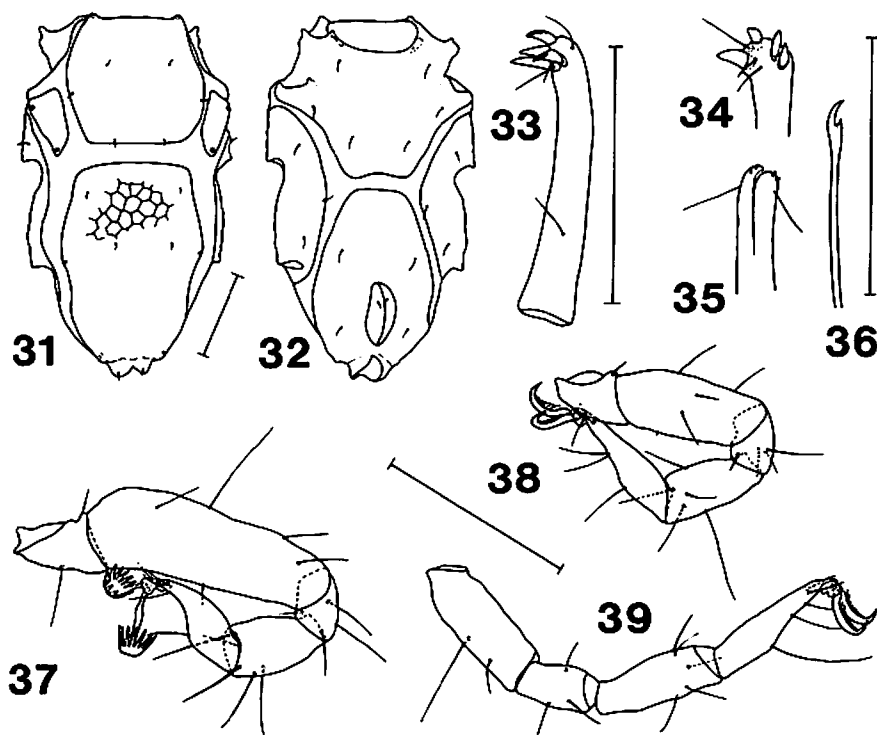
### *Saptognathides ornatus* Bartsch, n.sp.

Fig. 31-39

*Material.* One female holotype, in BPBM.

*Collecting data.* HAWAII: Kawaihae Bay, Spencer Beach, 1 m below low water level, medium sand and fine material, 15 XI 1979.

*Diagnosis.* Length of idiosoma 207  $\mu$ m, of gnathosoma 102  $\mu$ m. Dorsal plates coarsely ornamented. OC with 2 distinct gland pores. PD with 1 pair of gland pores at level of leg IV, and 1 pair posteriorly. Ds-2 and ds-3 inserted on AD, ds-4 on PD. Sgs present. Gnathosoma half the length of idiosoma. All tarsi with 3 dorsal setae.



Figures 31-39 *Scaptognathides ornatus* Bartsch, n.sp., ♀ 31, idiosoma, dorsal; 32, idiosoma, ventral; 33, palp, ventral; 34, tip of palp, medial; 35, tip of rostrum, ventral; 36, tip of chelicera; 37, leg I, medial; 38, leg II, lateral; 39, telofemur - tarsus III, medial. (each scale division = 50  $\mu$ m; 34, 35, 36 same scale)

**Description.** Female: Length of idiosoma 207  $\mu$ m. Dorsal plates covered with network formed by cuticular bars (Fig. 31), with several small pores within this network. AD quadrangular; a pair of gland pores projecting beyond anterior margin of plate. OC with 2 conspicuous gland pores. Corneae lacking. PD with 1 pair of gland pores at level of insertion leg IV, and 1 pair at end of idiosoma. Dorsal setae minute; ds-1, ds-2 and ds-3 inserted on AD, ds-4 and ds-5 on PD, and ds-6 on anal sclerites.

Ventral plates finely porose. AE with 3 pairs of setae, PE with 1 dorsal and 3 ventral setae. GA with 2 pairs of pgs. Distance anterior margin of GO to GA equalling almost  $1.5 \times$  length of GO (Fig. 32). One pair of minute sgs on genital sclerites.

Length of gnathosoma 102  $\mu$ m, i.e. almost half the length of idiosoma; gnathosomatic base angular, rostrum slender. First pair of maxillary setae close to base of rostrum, 2nd close to end of rostrum. Two pairs of minute spurs at rostral tip (Fig. 35). Palps 2-segmented, P-1 short; second palpal segment with 4 stout spines and 3 setae (Fig. 33, 34). Chelicerae slender (Fig. 36).

Leg I stronger than following legs (Fig. 37-39); telofemur I distinctly larger than all other segments (Fig. 37). Ventral setae on tibiae I slightly stronger than dorsal setae, but not spine-like. Chaetotaxy of leg I - IV: trochanter 1-1-1-1; basifemur 2-2-2-2; telofemur 5-5-2-2; genu 4-4-3-3; tibia 5-5-5-5. All tarsi with 3 dorsal setae. Tarsus I with 2 claws; claws with teeth arranged umbrella-like. Posterior legs with 2 claws; with teeth lined up along ventral flank of claw. Basal claw teeth longer than distal ones.

Male: Not seen.

*Remarks.* *Saptognathus ornatus* is similar to *S. planus* Monniot, a species known from the Bermuda Islands (Monniot 1972). Both species are similar in size and ornamentation of dorsal plates. The 2 species are easily separated by: the length of gnathosoma, in *S. planus* 75  $\mu\text{m}$ , in *S. ornatus* 102  $\mu\text{m}$ ; the absence of corneae in *S. ornatus*; the leg chaetotaxy, viz. in *S. planus* 4 setae on I-3, 4 dorsal setae on III-6, and 3 on IV-3, whereas *S. ornatus* has 5 setae on I-3, 3 dorsal setae on III-6, and 2 on IV-3.

## GEOGRAPHICAL DISTRIBUTION

Most of the halacarid genera are distributed worldwide. This is true, too, for the genera *Actacarus*, *Acarochelopodia* and *Saptognathus*.

*Actacarus* is reported from the northeast Atlantic and the adjacent Mediterranean, North Sea and Baltic (Bartsch 1977b; Bartsch & Schmidt 1979), from the northwest Atlantic (Krantz 1971, Bartsch 1977b), from the Pacific coast of both North America (Newell 1951, Krantz 1976) and South America (Newell 1984), the Galapagos Islands (Bartsch 1977a) and the Hawaiian Archipelago (Bartsch 1979), also from the Indian Ocean, from the Mozambique Channel (Bartsch 1982) and the Kerguelen Islands (Bov  e et al. 1973). Most records are from intertidal or shallow subtidal sediments, but at least one species (*A. obductus*) is known to live at a depth of 400 m (Bartsch 1977b). All species recorded are of small size; length of idiosoma of the smallest adult specimen is 150  $\mu\text{m}$  (*A. pygmaeus* — Bartsch 1976), of the largest *Actacarus* 350  $\mu\text{m}$  (*A. latus* — Newell 1984).

*Acarochelopodia* is recorded from the Mediterranean Sea and North Atlantic Ocean (Bartsch 1984), from the Pacific Ocean from the Galapagos Islands and the Hawaiian Archipelago (Bartsch 1977a, 1979). Most records are from the upper beach zone. All species known are small in size; length of idiosoma of the smallest adult ca. 140  $\mu\text{m}$  (*A. aduncispina* — Bartsch 1977a), of the largest 270  $\mu\text{m}$  (*A. cuneifera* — Bartsch 1977a).

The genus *Saptognathus* is represented by several species in all oceans. Three species are recorded from off Ireland and France (Halbert 1915; Monniot 1964), 4 species from the Mediterranean Sea (Andr   1961; Morselli & Mari 1982; unpublished data), 1 species from the Caribbean region (Bartsch 1984), and 3 species from the eastern Indian Ocean (Bartsch 1982). From the Eastern Pacific Ocean, *Saptognathus* is mentioned from the Galapagos Archipelago (2 species — Bartsch 1977a) and from off South America (3 species — Newell 1984); from the western Pacific from the Solomon Islands (1 species — Challis 1969) and from the

Philippines (1 species — unpublished record). *Scaptognathus* is reported from both fine and coarse sediments, from intertidal as well as from subtidal habitats. The smallest adult specimen is 150  $\mu\text{m}$  (*S. minutus* — Bartsch 1982), the largest adult 430  $\mu\text{m}$  in length (*S. trouessarti* — Halbert 1915).

*Scaptognathides* is only known from the western Atlantic and the eastern Pacific Ocean, from the Bermuda Islands (Monniot 1972), the Galapagos Islands (Bartsch 1977a) and the Hawaiian Islands (Bartsch 1979). On the Galapagos Islands, *Scaptognathides bicornis* is abundant and common throughout the Archipelago. All *Scaptognathides* are very delicate and small; idiosoma length of the smallest specimen is slightly less than 130  $\mu\text{m}$  (*S. bicornis* — Bartsch 1977a), length of the largest species 210  $\mu\text{m}$  (*S. planus* — Monniot 1972).

Halacarids are presumed to be an ancient group; several of the genera, probably, already inhabited the coasts of the Tethys Sea. *Scaptognathides* might be of younger age; though, records of *Scaptognathides* from both sides of Central America suggest that this genus existed and spread before the land bridge was formed.

## FEEDING

Members of the arenicolous halacarid genera have never been studied alive, their feeding has never been observed, so only hypotheses can be given here, based on the form of leg I and the gnathosoma.

### *Acarochelopodia*

Species of the genus *Acarochelopodia* have most remarkable first legs. When extended, they reach far beyond the tip of the rostrum. Leg I is much longer and highly modified when compared with the 3 posterior legs. Leg I certainly is not used for walking. Genu and tibia have very strong bipectinate spines, inserted along the ventral flank. The ventrolateral spine on genu I often is distinctly larger than the ventromedial one; the number of spines on the ventrolateral flank on tibia I is larger than that on the ventromedial flank. The tibia usually is wide and filled with muscle strings. The tarsus is slender and finger-like; its insertion into the tibia enables the tarsus to be clasped tightly against the ventral flank of the tibia. The first legs are well equipped to capture and tightly hold struggling prey organisms. The gnathosoma, too, is highly specialized. The upward turned palps with the wide, delicately pectinate bristles form a barrier posterior to the snout-like tip of the rostrum. The chelicerae with a rather short shaft and a claw-like end are of the shape usually found in halacarids. *Acarochelopodia* is specialized to capture meiofauna organisms, presumably worm-like prey (e.g. nematodes) which are held with the first legs while being sucked out.

### *Scaptognathus*

A unique characteristic in all *Scaptognathus* species is the huge, long gnathosoma with the distally wide, spatula-shaped rostrum and the palps

with strong spines ending just at the widened rostral tip. The tarsi of leg I do not surpass the rostrum. The chelicerae are extremely slender, stylet-shaped. Leg I often is slightly longer than the following legs. Pectinate bristles are present both on leg I and on the following legs. Presumably, *Scaptognathus* cannot catch or grip meiofaunal prey organisms but cling to larger preys, e.g. colonies of hydrozoans and bryozoans, feeding on parts of them.

### *Scaptognathides*

Species of the genus *Scaptognathides* are of very small size. Leg I is longer than the posterior ones; leg I reaches far beyond the rostral tip; strong spines are lacking. A conspicuous feature are the teeth arranged umbrella-like on the claws of tarsus I. The rostrum is narrow but not spatula-shaped. The palps surpass slightly the rostrum; the palpal spines are just opposite the rostral tip. Such umbrella-like claws are unique in marine halacarids, but similar claws are known from *Soldanellonyx* and *Parasoldanellonyx*, two in freshwater living halacarid genera. The feeding of both *Scaptognathides* and these freshwater halacarids is unknown.

### *Actacarus*

In the known species of the genus *Actacarus*, the first legs are hardly longer than the posterior legs. Leg I is rather slender; prominent bristles are lacking. Leg I is not specialized to capture prey organisms. The gnathosoma, as in most halacarid genera, has a slender, more or less triangular, rostrum and cylindrical palps attached laterally to the gnathosoma, and slightly extending beyond the rostrum. Species of *Actacarus* are usually pale, as the content in the gut caeca is yellowish. In the present material, in most of the specimens the body cavity was filled with green stuff. Thus, *Actacarus* may suck on algal cells, fixed on sediment grains or washed into the sediment.

## KEYS TO SPECIES

Keys to arenicolous adult halacarids, known from the northeast Pacific Ocean; genera *Actacarus*, *Acarochelopodia*, *Scaptognathus*, *Scaptognathides*.

### *Actacarus*

- 1a. AD and PD joined to dorsal shield ..... *uniscutatus*
- 1b. AD and PD separate ..... 2
- 2a. AD separate from PD for almost width of AD ..... *mollis*
- 2b. AD and PD broadly adjacent ..... 3
- 3a. Tectum with prominent spine, half as long
  - as rostrum ..... *hastatus*
- 3b. Tectum almost straight ..... 4
- 4a. AE with 4 pairs of setae; PE with 2 pairs of
  - ventral setae ..... *pacificus*
- 4b. AE with 3 pairs of setae; PE with 3 ventral setae ..... *illustrans*

*Acarochelopodia*

- 1a. Posterior tarsi with 3 large claws ..... 2  
 1b. Posterior tarsi with 2 large claws ..... 3  
 2a. Distance vs-2 to end of AE less than  
     distance vs-1 — vs-1 ..... *cuneifera*  
 2b. Distance vs-2 to end of AE more than  
     distance vs-1 — vs-1 ..... *triunguis* n.sp.  
 3a. AE with delicate, tail-like projection; tibia I with 6  
     bipectinate spines ..... *biunguis* n.sp.  
 3b. No tail-like projection on AE ..... 4  
 4a. Tibia I with 5 bipectinate spines ..... *aduncispina*  
 4b. Tibia I with 6 bipectinate spines ..... sp.

*Scaptognathus*

- 1a. Tibia I with 3 ventral bipectinate bristles ..... *gibbosus*  
 1b. Tibia I with 6 ventral bipectinate bristles ..... 2  
 2a. GA in female tripartite; dorsal plates reticulate ..... *kunzi* n.sp.  
 2b. GA in female bipartite; dorsal plates with  
     fine pores ..... *pauciporus*

*Scaptognathides*

- 1a. Setae ds-2, ds-3 and ds-4 within striated integument ..... *bicornis*  
 1b. Setae ds-2 and ds-3 on AD, ds-4 on PD ..... 2  
 2a. Dorsal plates coarsely reticulate; OC with 2 distinct gland  
     pores; idiosoma length ca. 200  $\mu$ m ..... *ornatus* n.sp.  
 2b. No reticulation on dorsal plates; OC with 1 distinct gland  
     pore; idiosoma length ca. 160  $\mu$ m ..... *hawaiiensis* n.sp.

## ACKNOWLEDGMENTS

Thanks are due to Dr H. Kunz and his wife for collecting and providing me with the marine mites.

## REFERENCES CITED

- André, M. 1961. Description d'une nouvelle espèce du genre *Scaptognathus* recueillie en Méditerranée (*Scaptognathus sabularius* n.sp.). *Acarologia* 3: 297-302.  
 Bartsch, I. 1976. Beitrag zur Halacariden-Fauna (Halacaridae, Acari) der Bretagneküste. Beschreibung von fünf Arten aus dem Sandlückensystem. *Acarologia* 17: 652-667.  
 Bartsch, I. 1977a. Interstitielle Fauna von Galapagos. XX. Halacaridae (Acari). *Mikrofauna Meeresboden* 65: 1-108.  
 Bartsch, I. 1977b. Eine neue *Actacarus*-Art (Acari, Halacaridae) aus dem Bathyal vor der Küste von North Carolina, USA. *Zool. Scr.* 6: 323-326.  
 Bartsch, I. 1979. Halacaridae (Acari) from Oahu Island (Hawaiian Archipelago). *Ent. Mitt. zool. Mus., Hamburg* 6 (97): 1-12.  
 Bartsch, I. 1982. Weitere Halacaridae (Acari) aus dem Kanal von Moçambique. *Cah. Biol. mar.* 23: 211-250.  
 Bartsch, I. 1984a. Halacaridae (Acari) von den westindischen Inseln. *Bijdr. Dierk.* 54: 185-196.  
 Bartsch, I. 1984b. Ergänzungen zur Halacariden-Fauna der Bretagne-Küste und Beschreibung einer neuen Art (Halacaridae, Acari). *Cah. Biol. mar.* 25: 113-122.

- Bartsch, I. & P. Schmidt. 1979. Zur Verbreitung und Ökologie einiger Halacaridae (Acari) in Sandstränden der Ostsee (Kieler Bucht), der Nordsee (Sylt) und des Europäischen Nordmeeres (Tromsø). *Mikrofauna Meeresboden* 74: 1-37.
- Bovée, de F., N. Coineau, J. Soyer & J. Travé. Sur l'existence d'une faunule interstitielle littorale dans l'Archipel de Kerguelen (Terres Australes en Antarctiques Françaises). *C. r. Acad. Sci. Paris, D*, 276: 1041-1044.
- Challis, D.A. 1969. An interstitial fauna transect of a Solomon Islands sandy beach. *Phil. Trans. R. Soc., B*. 255: 517-526.
- Halbert, J.N. 1915. Acarinida: II. Terrestrial and marine acarina. *Proc. R. Ir. Acad. (II)* 31: 45-136.
- Krantz, G.W. 1971. The mites of Quintana Roo. II. *Actacarus giganteus*, a new species of arenicolous mite (Prostigmata: Halacaridae) from the Caribbean coast. *Ann. ent. Soc. Am.* 64: 594-598.
- Krantz, G.W. 1976. Arenicolous Halacaridae from the intertidal zone of Schooner Creek, Oregon (Acari: Prostigmata). *Acarologia* 18: 241-258.
- Monniot, F. 1964. Sur deux espèces du genre *Scaptognathus* présentes a Roscoff. *Acarologia* 6: 491-498.
- Monniot, F. 1964. Sur deux espèces du genre *Scaptognathus* présentes a Roscoff. *Acarologia* 6: 491-498.
- Morselli, I. & M. Mari. 1982. Alacaridi (Acari, Prostigmata) di fondi sabbiosi della costa ionica del Salento. *Atti Soc. Tosc. Sc. Nat. Mem., B*, 88: 229-247.
- Newell, I.M. 1951. Further studies on Alaskan Halacaridae (Acari). *Am. Mus. Novit.* 1536: 1-56.
- Newell, I.M. 1984. Antarctic Halacaroida. *Antarct. Res. Ser.* 40: 1-284.